

ATom-4 Science Flight Report

20180509 RF07 PUQ – PUQ: Antarctic Flight (Round Trip)

Take Off 11:53 UTC, duration 10.7 hours.

Mission Science: Tom Ryerson. **Meteorology:** Karen Rosenlof and Eric Ray

Author of this note: SCW

This flight was designed to sample the troposphere between 53 S and 85 S, in order to measure the influence of anthropogenic processes on the chemical and aerosol components of this most remote part of the atmosphere. Four dips were scheduled, including at 85 S over the dome of the Antarctic ice sheet. The return leg was intended to measure the composition and chemical gradients of the lower stratosphere in the early period of the formation of the polar vortex. The plan was modified during the flight to obtain two additional dips while doing the stratospheric transect.

Notes from the flight:

The climb out went to 31k. The first dive was executed early to catch a hole in the clouds. We had a lovely view of the terminator to the right of the heading. Crossed into the stratosphere early on climb out.

The measurement AO2_Cabin_T was added to the ChemWad feed to facilitate control of cabin temperature.

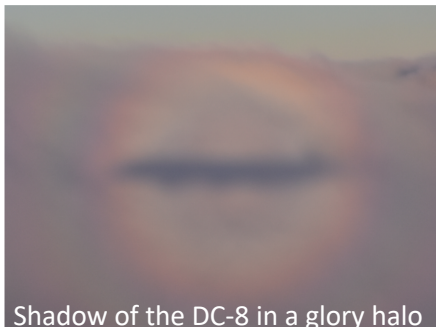
HCHO/ ISAS failed, is not measuring today and may not be recoverable.

The profiles showed the bulge towards the top of the troposphere in CH₄ and CO that we have been seeing, and that was forecast (for CO). Some of these features showed excess benzene, some did not. Most showed excess methanol and SP2. Both profiles near the coast on the return leg showed high DMS. The highest concentrations of these pollutants were typically jammed right up against the tropopause, similarly to (but much more dilute than) the "River of pollution" that we saw in ATom-3, streaming from equatorial SE Asia, New Guinea, and Australia..

We entered the polar night after dip 2, returning to daylight on the way back. We added an extra partial dip over the ice shelf, seeing DMS and Sea Salt (!) on the last dive, plus methanol and even some butane.

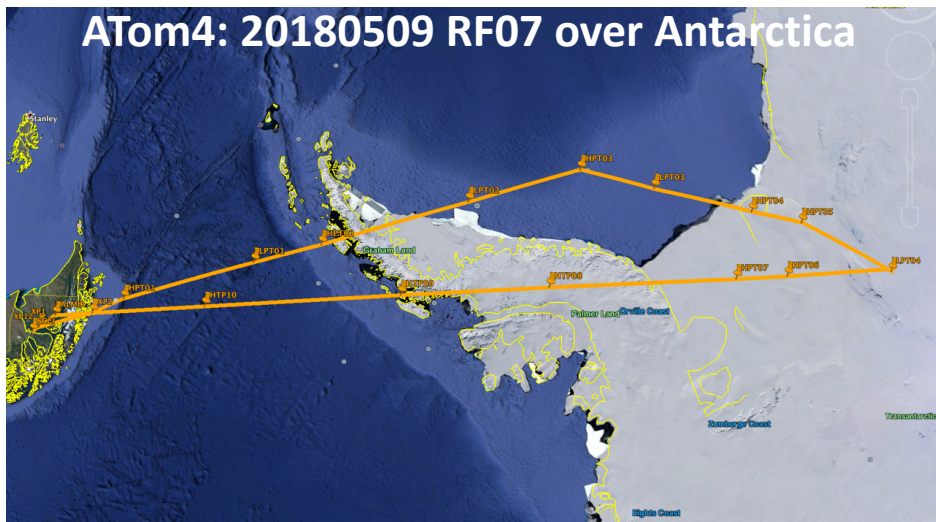
Added a final low point near Chile coast, suggested by the pilot Wayne Ringelberg.

The attached figures show the route, some live feed data (not to be used in publications or presentations), and some photographs of the mission.



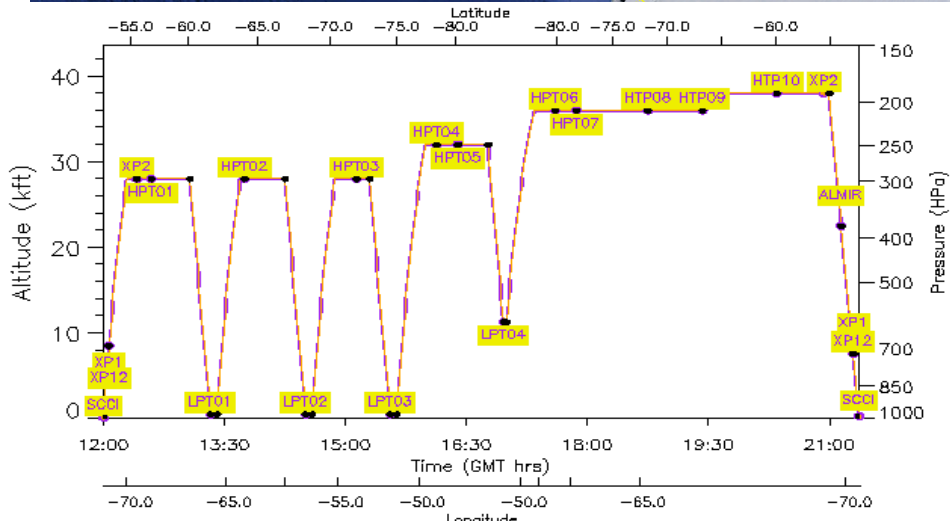
Shadow of the DC-8 in a glory halo

Photo: B. Weinzerl

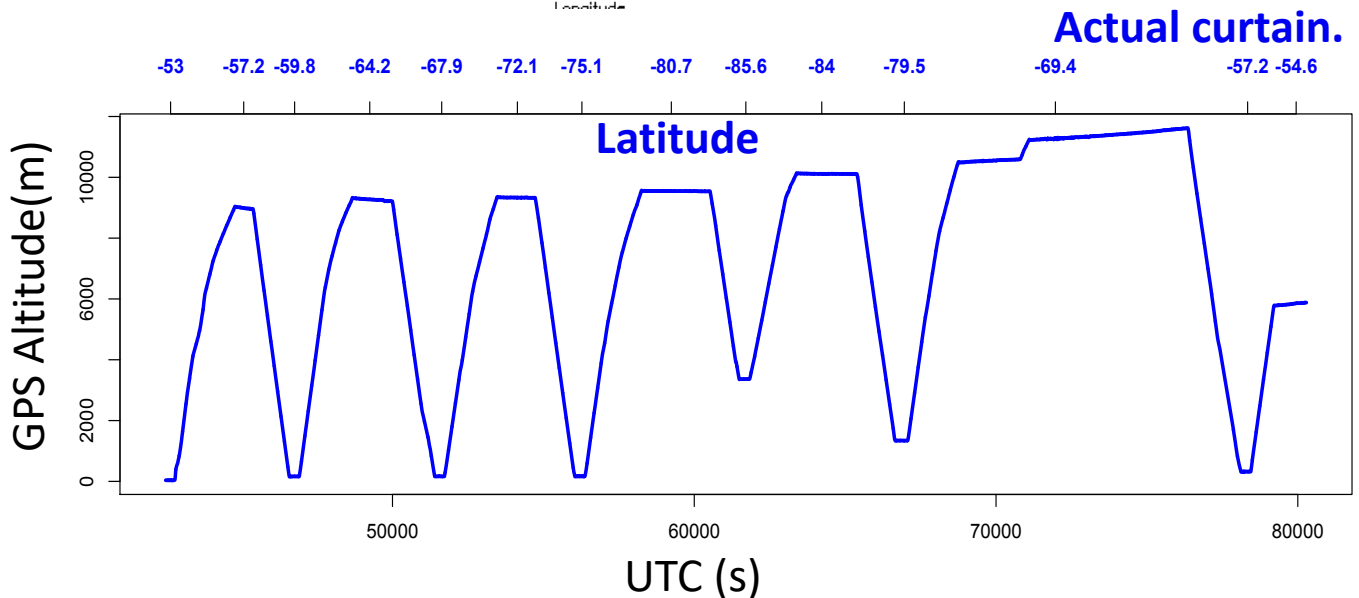


Planned ground track.

Actual ground track was close to plan.

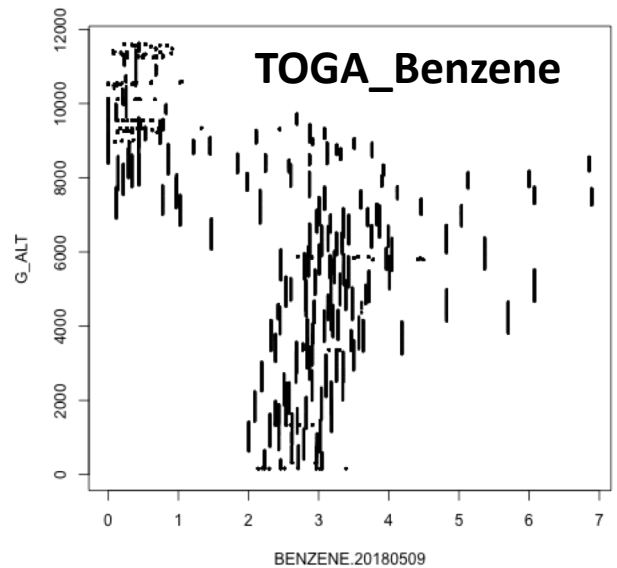
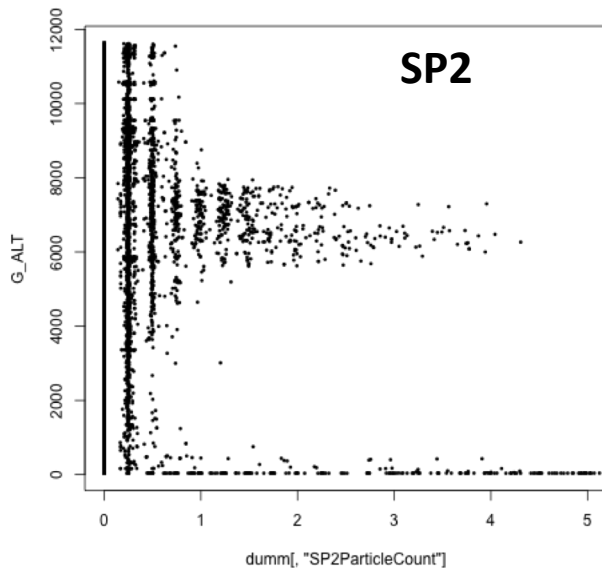
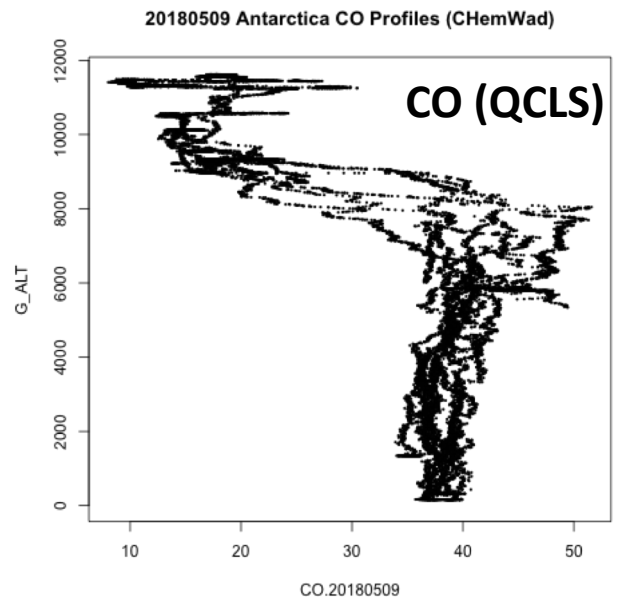


Planned curtain.

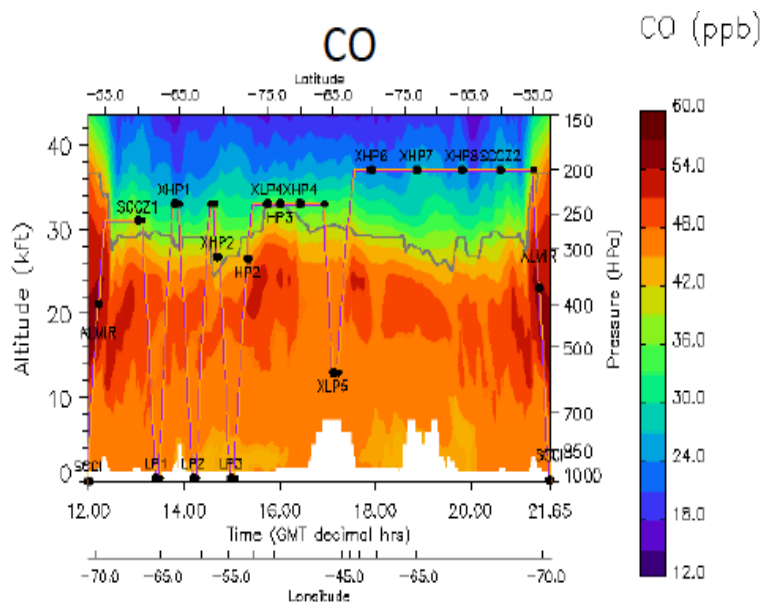


Planned route and curtain plot (top two panels), and actual curtain plot (lower) showing two additional dips.

Dilute signals of combustion observed in the upper troposphere over Antarctica. Note the distinctive “inverted” profiles, with the highest concentrations of gases near the tropopause, but the peak SP2 shifted to lower altitude. *(From the onboard data feed; not for publication or presentation.)* 💀



The GMAO chemistry forecast: Excellent agreement when compared to measured CO. In this region, the model does not report the origin of the excess CO with specificity. The model also does not capture the observations of BC at all.



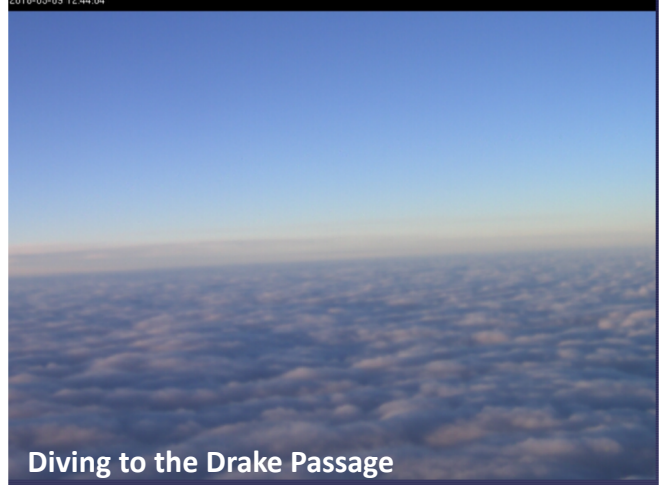
Images from ATom-4 RF07: PUQ – PUQ (Antarctica RT)

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2018-05-09 13:04:00

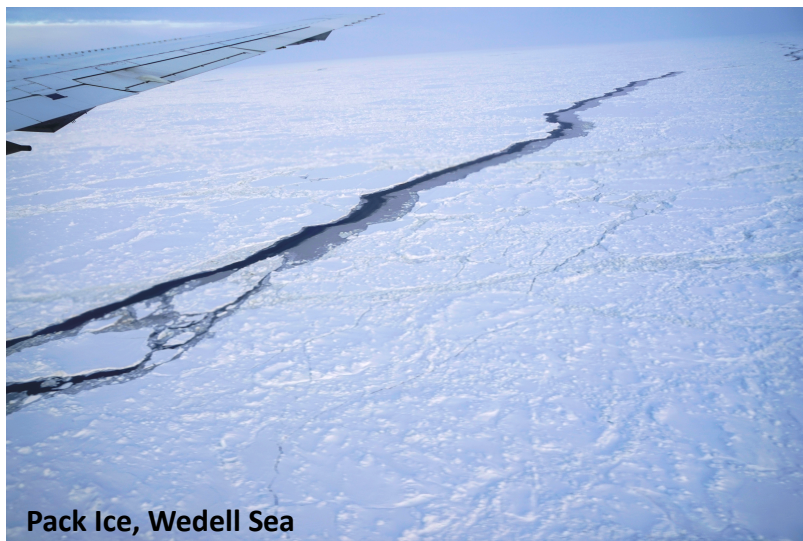


Climb from dip 1
Forward CAM.

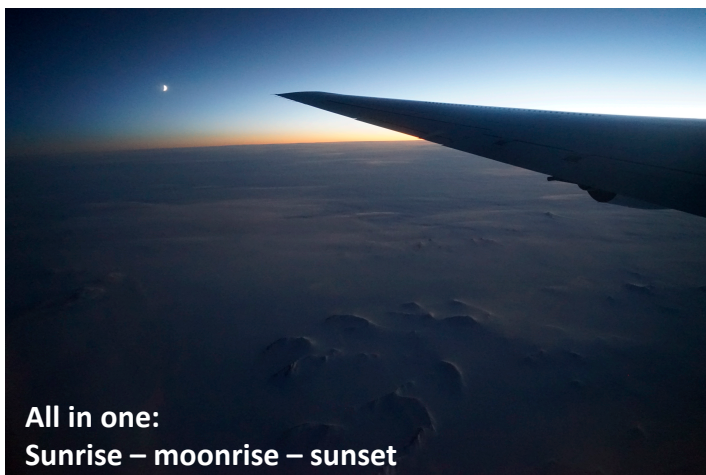
time: 2018-05-09 12:44:04.013 Latitude: -58.37.5 Longitude: -067.43.8
2018-05-09 12:44:04



Diving to the Drake Passage
Forward CAM.



Pack Ice, Wedell Sea
Photo: SCW



All in one:
Sunrise – moonrise – sunset
Photo: SCW



Antarctic coastal Island
Photo: SCW